4E ALUMINUM (SIC 333/5)

EPA's *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures* identified four 4-digit SIC codes in the nonferrous metals industries (SIC codes 333/335) with at least one existing facility that operates a CWIS, holds a NPDES permit, withdraws more than two million gallons per day (MGD) from a water of the United States, and uses at least 25 percent of its intake flow for cooling purposes, (facilities with these characteristics are hereafter referred to as "§316(b) facilities"). For each of the four SIC codes. Table 4E-1 below provides a description of the industry sector, a list of products manufactured, the total number of screener survey respondents (weighted to represent national results), and the number and percent of §316(b) facilities.

Table 4E-1: §316(b) Facilities in the Nonferrous Industries (SIC 333/335)

SIC	SIC Description	Important Products Manufactured	Number of Screener Respondents (Weighted)		
			Total	§316(b) Facilities	
				No. †	%
Primary Aluminum Production and Aluminum Shapes (SIC 3334 & 3353)					
3334	Primary Production of Aluminum	Producing aluminum from alumina and in refining aluminum by any process	31	10	32.6%
3353	Aluminum Sheet, Plate, and Foil	Flat rolling aluminum and aluminum-base alloy basic shapes, such as rod and bar, pipe and tube, and tube blooms; producing tube by drawing	57	6	10.9%
Total			***88***	***16***	***18.5%***
Other SIC 333/335					
3339	Primary Smelting and Refining of Nonferrous Metals, Except Copper and Aluminum	Smelting and refining nonferrous metals, except copper and aluminum	6	1	19.6%
3357	Drawing and Insulating of Nonferrous Wire	Drawing, and/or insulating wire and cable of nonferrous metals from purchased wire bars, rods, or wire; insulated fiber optic cable	48	0	0.0%
Total			***53***	***1***	***2.1%***
Total Nonferrous					
Total 333/5			**141**	**17**	**12.3%**

† Information on the percentage of intake flow used for cooling purposes was not available for all screener respondents. Facilities for which this information was not available were assumed to use at least 25% of their intake flow for cooling water purposes The reported numbers of §316(b) facilities may therefore be overstated.

Source: EPA, Industry Screener Questionnaire: Phase I Cooling Water Intake Structures, 1999; Executive Office of the President, Office of Management and Budget, Standard Industrial Classification Manual 1987.

The responses to the Screener Questionnaire indicate that aluminum producers account for the largest number of nonferrous metals §316(b) facilities. Of the 17 §316(b) facilities in the four nonferrous SIC codes, 16 facilities, or 94 percent, are either primary aluminum producers (SIC code 3334) or producers of flat-rolled aluminum and aluminum shapes (aluminum sheet, plate and foil, SIC code 3353.) This profile therefore focuses on the primary aluminum production and aluminum shapes sectors.

4E.1 Domestic Production

Commercial production of aluminum using the electrolytic reduction process, known as the Hall-Heroult process, began in the late 1800s. The production of primary aluminum involves mining bauxite ore and refining it into alumina, one of the feedstocks for aluminum metal. Direct electric current is used to split the alumina into molten aluminum metal and carbon dioxide. The molten aluminum metal is then collected and cast into ingots. Technological improvements over the years have improved the efficiency of aluminum smelting, with a particular emphasis on reducing energy requirements. There is currently no commercially viable alternative to the electrometallurgical process (Aluminum Association, 2000).

Almost half of all U.S.-produced aluminum (48.1 percent of U.S. output in 1998) comes from recycled scrap. Recycling consists of melting used beverage cans and scrap generated from operations. Recycling saves approximately 95 percent of the energy costs involved in primary smelting from bauxite (S&P, 2000). No secondary smelters (included, along with secondary smelting of other metals, in SIC code 3341) were reported in EPA's screener survey. These facilities are therefore not addressed in this profile.

Facilities in SIC code 3353 produce semifabricated products from primary or secondary aluminum. Examples of semifabricated aluminum products include (Aluminum Association, undated):

- sheet (cans, construction materials and automotive parts);
- plate (aircraft and spacecraft fuel tanks);
- foil (household aluminum foil, building insulation and automotive parts)
- rod, bar and wire (electrical transmission lines); and
- extrusions (storm windows, bridge structures and automotive parts).

U.S. aluminum companies are generally vertically integrated. The major aluminum companies own large bauxite reserves, mine bauxite ore and refine it into alumina, produce aluminum ingot, and operate the rolling mills and finishing plants used to produce semifabricated aluminum products (S&P, 2000).

a. Output

The largest single source of demand for aluminum is the transportation sector, primarily the manufacture of motor vehicles. Demand for lighter more fuel efficient vehicles has led to increased demand for aluminum in auto manufacturing, at the expense of steel (S&P, 2000). Production of beverage cans is also a major use of aluminum sheet, and aluminum has almost entirely replaced steel in the beverage can market. Other major uses of aluminum include construction (including aluminum siding, windows and gutters) and consumer durables (source).

Demand for aluminum reflects the overall state of the domestic and world economies, as well as long-term trends in materials use in major end-use sectors. The years 1990 through 1999 have include strong demand for aluminum from domestic sources and variable demand from overseas customers, due in large part to stagnant economies in Asia in the late 1990s.

Table 4E-2 shows trends in output of aluminum by primary aluminum producers and recovery of aluminum from old and new scrap. Secondary production has grown from 37 percent to almost half of total domestic supply over the period from 1990 to 1999.

Table 4E-2: Quantities of Aluminum Produced (thousand metric tons)

Year	Aluminum Ingot	
	Primary Production	Secondary Production (from old & new scrap)
1990	4,048	2,390
1991	4,121	2,290
1992	4,042	2,760
1993	3,695	2,940
1994	3,299	3,090
1995	3,375	3,190
1996	3,577	3,310
1997	3,063	3,550
1998	3,713	3,440
1999†	3,800	3,490

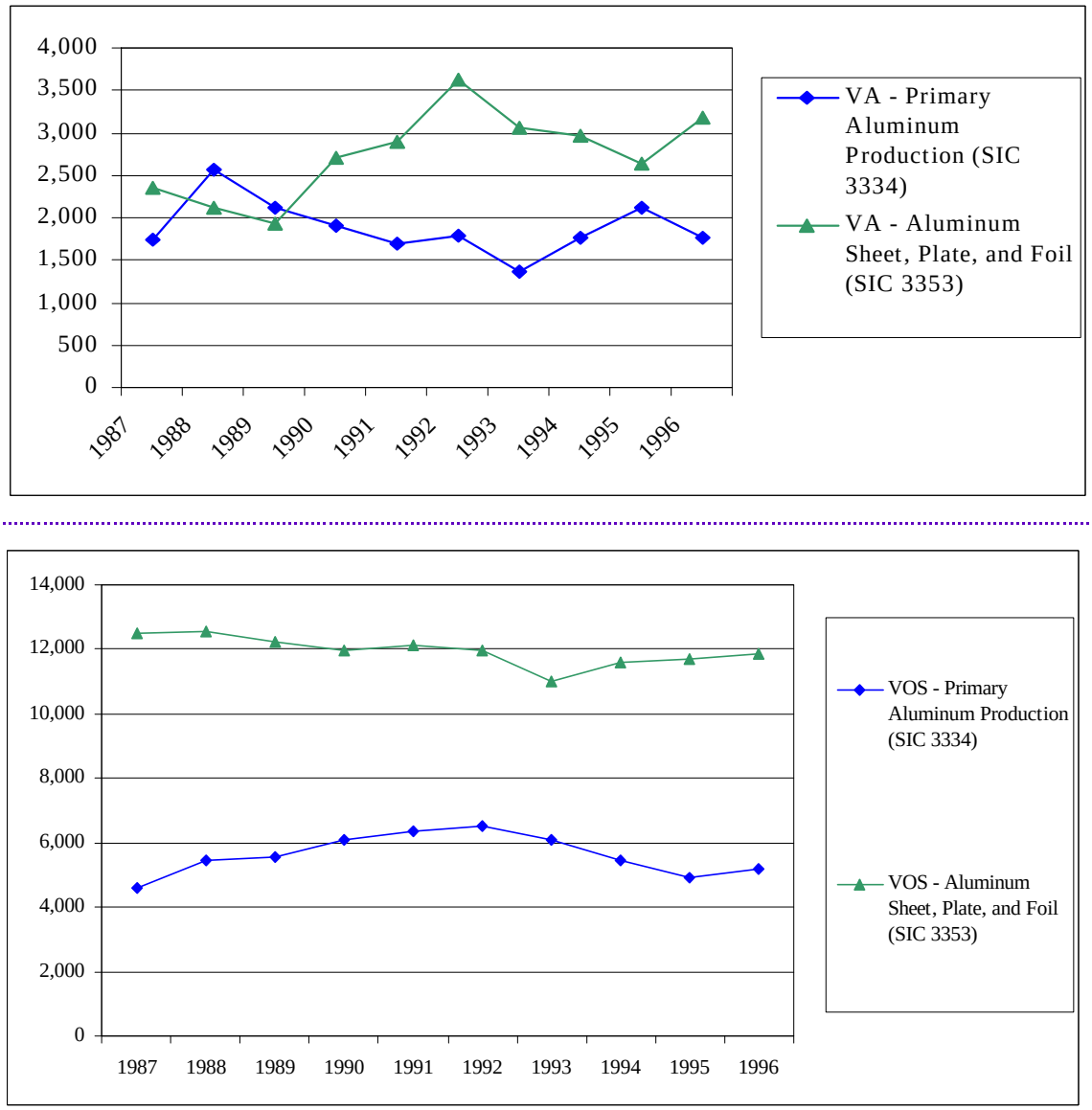
† Forecast

Source: U.S. Industry and Trade Outlook '99, American Metal Market Metal Statistics 1999, USGS 2000.

Value of shipments and ***value added*** are two measures of the value of manufacturing output.[1] Figure 4E-1 presents trends in value of shipments and value added for the primary aluminum and aluminum sheet, plate, and foil sectors between 1987 and 1996.

[1] Terms highlighted in bold and italic font are further explained in the glossary.

Figure 4E-1: Real Value of Shipments and Value Added for Profiled Aluminum Sectors ($1999 million)



Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

Figure 4E-1 shows that real value added and value of shipments in the primary aluminum sector decreased steadily from 1988 to 1993. This decrease coincided with a period of rapidly declining prices resulting from a decrease in the demand for aluminum and oversupply in the global market that occurred when large amounts of Russian aluminum entered the market in the early 1990s. The recovery in the mid-1990s resulted from an increased demand for aluminum, driven by increased consumption by the transportation, container, and construction sectors.

Value added in the aluminum sheet, plate, and foil sector increased between 1989 and 1992 and decreased thereafter. Demand for semifinished aluminum products reflects demand from the transportation, container, and building industries. The increases in value added through the early 1990s were fueled by strong demand from the container and packaging sector. The decreases seen in the mid-1990s reflect a decrease in demand from this sector resulting from improved technology for producing aluminum cans and a stagnant demand for products packaged in cans.

Value of shipments for both of the profiled aluminum sectors follow similar trends between 1989 and 1996.

b. Prices

Figure 4E-2 shows the ***producer price index*** (PPI) at the 4-digit SIC code for the profiled aluminum sectors. The PPI is a family of indexes that measure price changes from the perspective of the seller. This profile uses the PPI to inflate nominal monetary values to constant dollars. Sharp changes in prices reflect the cyclical nature of this industry and major changes in world markets.

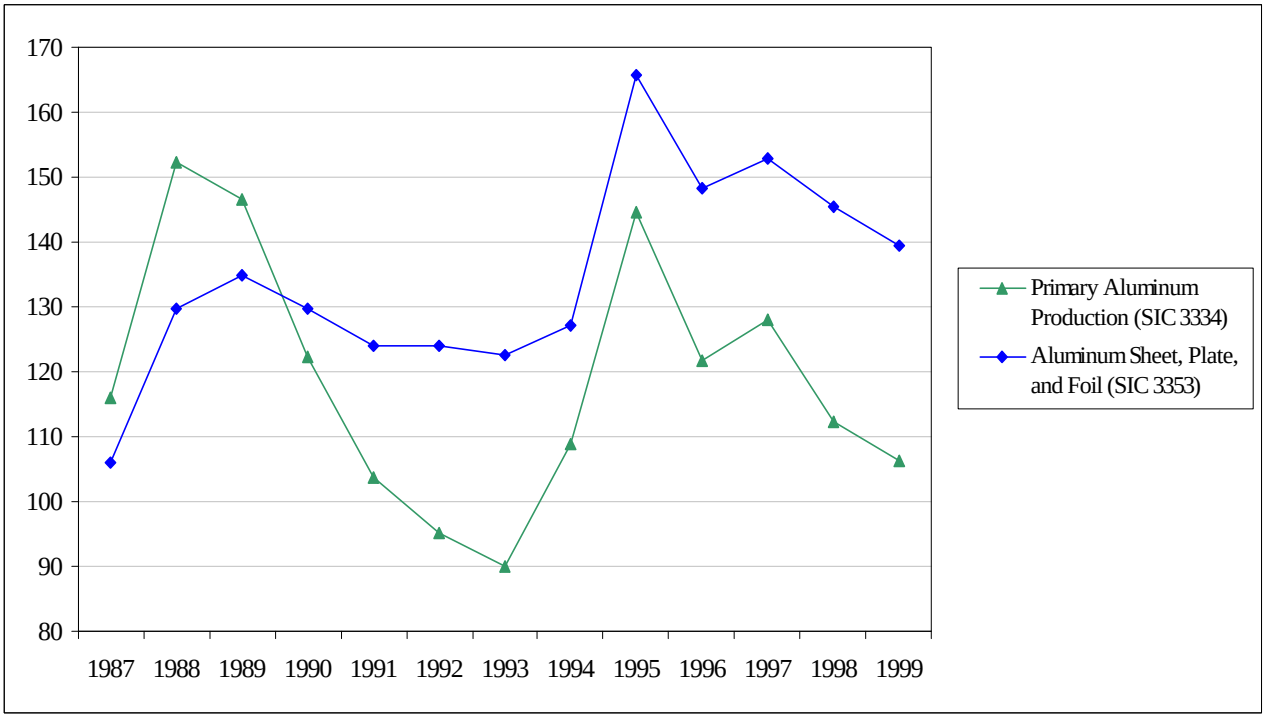
During the early 1980s, the aluminum industry experienced oversupply, high inventories, excess capacity, and weak demand, resulting in falling prices for aluminum. By 1986, much of the excess capacity had been permanently closed, inventories had been worked down, and worldwide demand for aluminum increased dramatically. This resulted in dramatic price increases through 1988.

In the early 1990s, the dissolution of the Soviet Union had a major impact on aluminum markets. Large quantities of Russian aluminum that had formerly been consumed internally, primarily in military applications, were sold in world markets to generate hard currency. At the same time, world demand for aluminum was decreasing. The result was increasing inventories and depressed aluminum prices.

The United States and five other primary aluminum producing nations signed an agreement in January 1994 to curtail global output, in response to the sharp decline in aluminum prices. At the time of the agreement, there was an estimated global overcapacity of 1.5 to 2.0 million metric tons per year (S&P, 2000).

By the mid-1990s, production cutbacks, increased demand, and declining inventories led to a sharp rebound of prices. Prices have again declined since the late 1990s, when the economic crises in Asian markets reduced the demand for aluminum (USGS, 2000). Russian exports remain high, and there is a continuing potential for depressed prices if substantial amounts of idled capacity are brought back on-line in response to improving world economic conditions.

Figure 4E-2: Producer Price Indexes for Profiled Aluminum Sectors



Source: Bureau of Labor Statistics, Producer Price Index.

c. Number of Facilities and Firms

The primary aluminum sector is dominated by a few very large integrated, multinational U.S. companies which own the majority of smelting facilities operating today. In 1999, there were 23 primary aluminum reduction plants operating in the U.S., owned by 12 companies (USGS, 2000). These 12 companies owned total primary capacity of 4.2 million metric tons. The three largest firms account for 62 percent of U.S. primary capacity (Alcoa Inc. for 45 percent, Reynolds for almost 11 percent, and Kaiser Aluminum Corp. for almost 7 percent) (S&P, 2000).

Statistics of U.S. Businesses data show considerable variation in the number of primary aluminum facilities between 1989 and 1996. Table 4E-3 shows that the number of primary aluminum facilities decreased by 30 percent between 1991 and 1995, with the majority of this decrease, 27 percent, occurring between 1991 and 1993. The fluctuation in the number of facilities reflects the market conditions described earlier.

The number of facilities in the aluminum sheet, plate, and foil sector has shown a more consistent trend, increasing each year except 1993. The upward trend in numbers of facilities in the early 1990s reflects the high levels of capacity utilization and dramatic increase in demand for aluminum prevalent at that time. The sharp decrease in the number of facilities in 1993 resulted from declining economic conditions and oversupply in the global market for aluminum. This decrease was followed by another period of increases in the number of facilities.

Table 4E-3: Number of Facilities for Profiled Aluminum Sectors

Year	Primary Aluminum Production (SIC 3334)		Aluminum Sheet, Plate, and Foil (SIC 3353)	
	Number of Establishments	Percent Change	Number of Establishments	Percent Change
1989	56	n/a	61	n/a
1990	54	-3.6%	64	4.9%
1991	57	5.6%	73	14.1%
1992	52	-8.8%	73	0.0%
1993	44	-15.4%	63	-13.7%
1994	41	-6.8%	69	9.5%
1995	40	-2.4%	76	10.1%
1996	51	27.5%	81	6.6%
Percent Change 1989-1996		-8.9%		32.8%

Source: Small Business Administration, Statistics of U.S. Businesses.

The trend in the number of firms over the period between 1989 and 1996 has been similar to the trend in the number of facilities in both industry sectors. Table 4E-4 presents information on the number of firms in each sector between 1989 and 1996.

Table 4E-4: Number of Firms for Profiled Aluminum Sectors

Year	Primary Aluminum Production (SIC 3334)		Aluminum Sheet, Plate, and Foil (SIC 3353)	
	Number of Firms	Percent Change	Number of Firms	Percent Change
1990	38	n/a	43	n/a
1991	41	7.9%	53	23.3%
1992	36	-12.2%	53	0.0%
1993	33	-8.3%	45	-15.1%
1994	30	-9.1%	47	4.4%
1995	30	0.0%	51	8.5%
1996	40	33.3%	56	9.8%
Percent Change 1990-1996		5.3%		30.2%

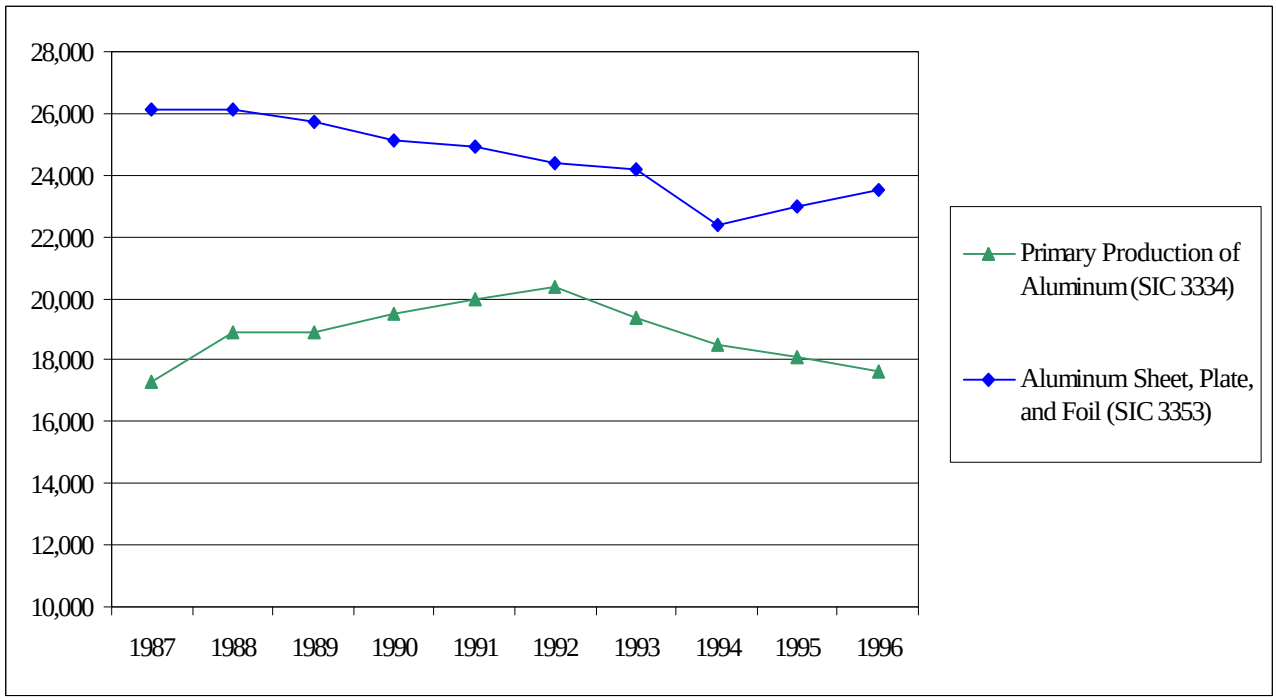
Source: Small Business Administration, Statistics of U.S. Businesses.

d. Employment and Productivity

Figure 4E-3 below provides information on employment from the Annual Survey of Manufactures for the primary aluminum and aluminum plate, sheet, and foil sectors. The figure shows that employment trends in the primary aluminum production sector increased throughout the late 1980s and early 1990s. Employment in this sector declined each year from its peak in 1992 through 1996 as a result of the market conditions described previously.

Employment in the aluminum sheet, plate, and foil sector has been declining since 1987. There were 26,100 people employed in the aluminum sheet sector in 1987 but only 23,500 in 1996. This decrease in employment reflects the technological advances seen in the production of aluminum cans, a major end user of aluminum sheet and foil, and a decreased demand from the container and packaging sector (McGraw-Hill, 1998).

Figure 4E-3: Employment for Profiled Aluminum Sectors



Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

Table 4E-5 presents the change in value added per labor hour, a measure of ***labor productivity***, for the primary aluminum and aluminum plate, sheet, and foil sectors between 1987 and 1996. The trend in labor productivity in both sectors has shown a fair amount of volatility over this period. Value added per hour in the primary aluminum sector decreased 47 percent between 1988 and 1993 but only one percent between 1987 and 1996.

Value added per hour in the aluminum sheet, plate, and foil sector saw substantial increases in the early 1990s improving by 48 percent between 1989 and 1992 and 40 percent between 1988 and 1996.

Table 4E-5: Productivity Trends for Profiled Aluminum Sectors

Year	Primary Production of Aluminum (SIC 3334)				Aluminum Sheet, Plate, and Foil (SIC 3353)			
	Value Added (million $1999)	Production Hours (millions)	Value Added/Hour		Value Added (million $1999)	Production Hours (millions)	Value Added/Hour	
			$1999	Percent Change			$1999	Percent Change
1987	1740	28	63	n/a	2356	40	59	n/a
1988	2559	32	80	27%	2109	41	51	-13%
1989	2127	30	70	-12%	1928	41	47	-8%
1990	1917	32	60	-15%	2700	40	68	44%
1991	1691	32	53	-12%	2900	39	74	8%
1992	1799	32	56	6%	3630	40	91	23%
1993	1354	29	47	-16%	3065	39	79	-13%
1994	1753	27	65	40%	2967	37	81	2%
1995	2113	28	75	15%	2633	38	69	-15%
1996	1763	29	62	-17%	3174	39	82	19%
Percent Change 1988-1996				-1%				40%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

e. Capital Expenditures

Aluminum production is a highly capital intensive process. Capital expenditures are needed to modernize, replace, and when market conditions warrant, expand capacity. Environmental issues also require major capital expenditures. Possible measures required to reduce greenhouse gas (GHG) emissions may require significant expenditures by aluminum producers. The industry expects to spend a few hundred million dollars to reduce toxic air emissions by half and to reduce particulate emissions under Clean Air Act requirements (McGraw-Hill, 1998).

Capital expenditures in the primary aluminum and aluminum plate, sheet, and foil sectors between 1987 and 1996 are presented in Table 4E-6 below. The table shows that capital expenditures in the primary aluminum sector increased throughout the early 1990s, peaking in 1993. This period of increased capital investment was followed by a significant decrease of 54 percent between 1993 and 1995. These decreases resulted from the production cutbacks and capacity reductions implemented in response to oversupply conditions prevalent in the market for aluminum.

Capital expenditures in the aluminum plate, sheet, and foil sector have also fluctuated considerably between 1987 and 1996. Producers of aluminum plate, sheet and foil reduced capital expenditures by 35 percent between 1988 and 1996.

Table 4E-6: Capital Expenditures for Profiled Aluminum Sectors ($1999 millions)

Year	Primary Aluminum Production (SIC 3334)		Aluminum Sheet, Plate, and Foil (SIC 3353)	
	Capital Expenditures	Percent Change	Capital Expenditures	Percent Change
1987	159	n/a	578	n/a
1988	103	-35%	564	-2%
1989	132	29%	571	1%
1990	163	24%	733	28%
1991	213	30%	638	-13%
1992	240	13%	470	-26%
1993	197	-18%	275	-42%
1994	118	-40%	300	9%
1995	111	-5%	319	6%
1996	181	62%	376	18%
Percent Change 1987-1996		14%		-35%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

f. Capacity Utilization

Capacity utilization measures actual output as a percentage of total potential output given the available capacity. Capacity utilization reflects excess or insufficient capacity in an industry and is an indication of whether new investment is likely.

Figure 4E-4 presents the capacity utilization index from 1989 to 1998 for the primary aluminum and aluminum sheet, plate, and foil sectors. The figure shows that for most of the 1990s, the primary aluminum industry was characterized by excess capacity. The capacity utilization index for this sector was near 100 percent between 1990 and 1992, and then decreased sharply in 1993 as large amounts of Russian aluminum entered the global market for the first time (McGraw-Hill, 1999). Capacity utilization remained low through 1996, reflecting the continued oversupply in the global aluminum market.

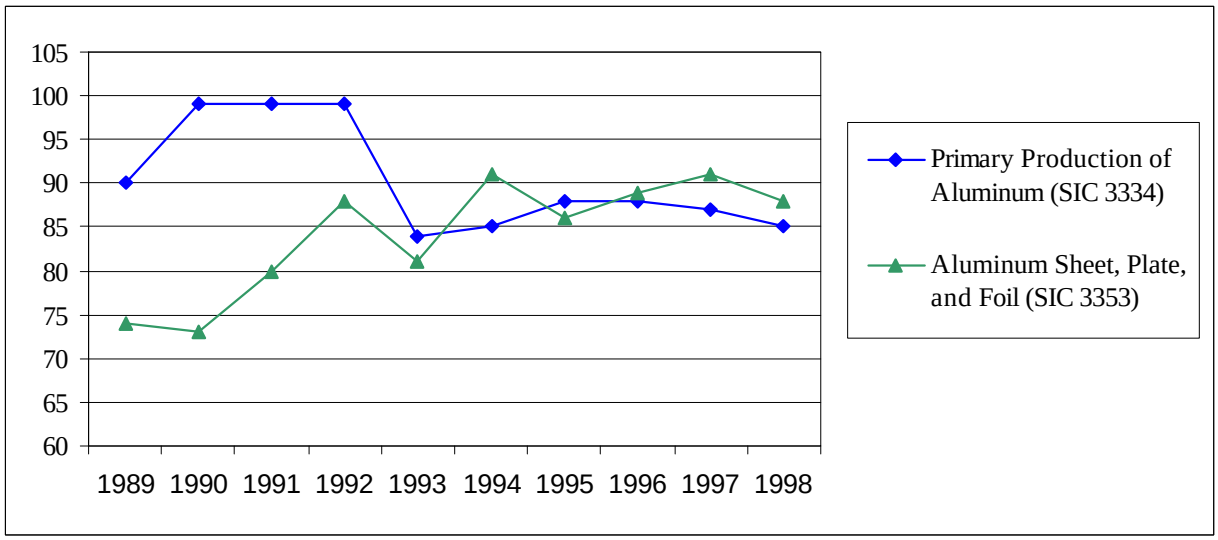
There continues to be a substantial amount of idled capacity

in the U.S. that could be brought on-line as demand improves, which is likely to limit construction of new capacity and to limit price increases for aluminum (S&P, 2000). The annual USGS report on aluminum for 1998 reported that capacity expansions were being planned or studied at three primary smelters, that capacity was being brought back on-line at five facilities, and that capacity had been or would soon be idled at another four smelters during 1998. There has not been any new smelter capacity constructed in the United States since 1980 (McGraw-Hill, 1999). Deregulation of the U.S. power industry may encourage some smelter expansions in the U.S., if electricity prices decrease significantly once electricity markets are deregulated .

There are some aluminum minimills in the U.S., but in contrast to the steel industry, their impact on the profitability of traditional aluminum companies has been limited. Aluminum minimills are not able to produce can sheet of the same quality as that produced by integrated facilities. They are able to compete only in production of commodity sheet products for the building and distributor markets, which are considered mature markets. According to Standard & Poor's, construction of new minimill capacity is unlikely given the potential that added capacity would drive down prices in the face of slow growth in the markets for minimill products (S&P, 2000).

Capacity utilization in the aluminum sheet, plate, and foil sector has fluctuated but shows an overall positive trend between 1989 and 1998. This positive trend is largely driven by the continued strength of rolled aluminum products which account for more than 50 percent of all shipments from the aluminum industry. Increased consumption by the transportation sector, the largest end-use sector for aluminum, is responsible for bringing idle capacity into production (McGraw-Hill 1999).

Figure 4E-4: Capacity Utilization Index for Profiled Aluminum Sectors



Source: Department of Commerce, Bureau of the Census, Current Industrial Reports, Survey of Plant Capacity.

4E.2 Structure and Competitiveness

Aluminum production is a highly-concentrated industry. A number of large mergers among aluminum producers that have occurred recently that will increase the degree of concentration in the industry. For example, Alcoa (the largest aluminum producer) acquired Alumax (the third largest producer) in 1998. Some sources speculate that, with increased consolidation resulting from mergers, aluminum producers might refrain from returning idle capacity to production as demand for aluminum grows. This could reduce the cyclical volatility in production and aluminum prices that has characterized the industry in the past (S&P, 2000).

a. Geographic Distribution

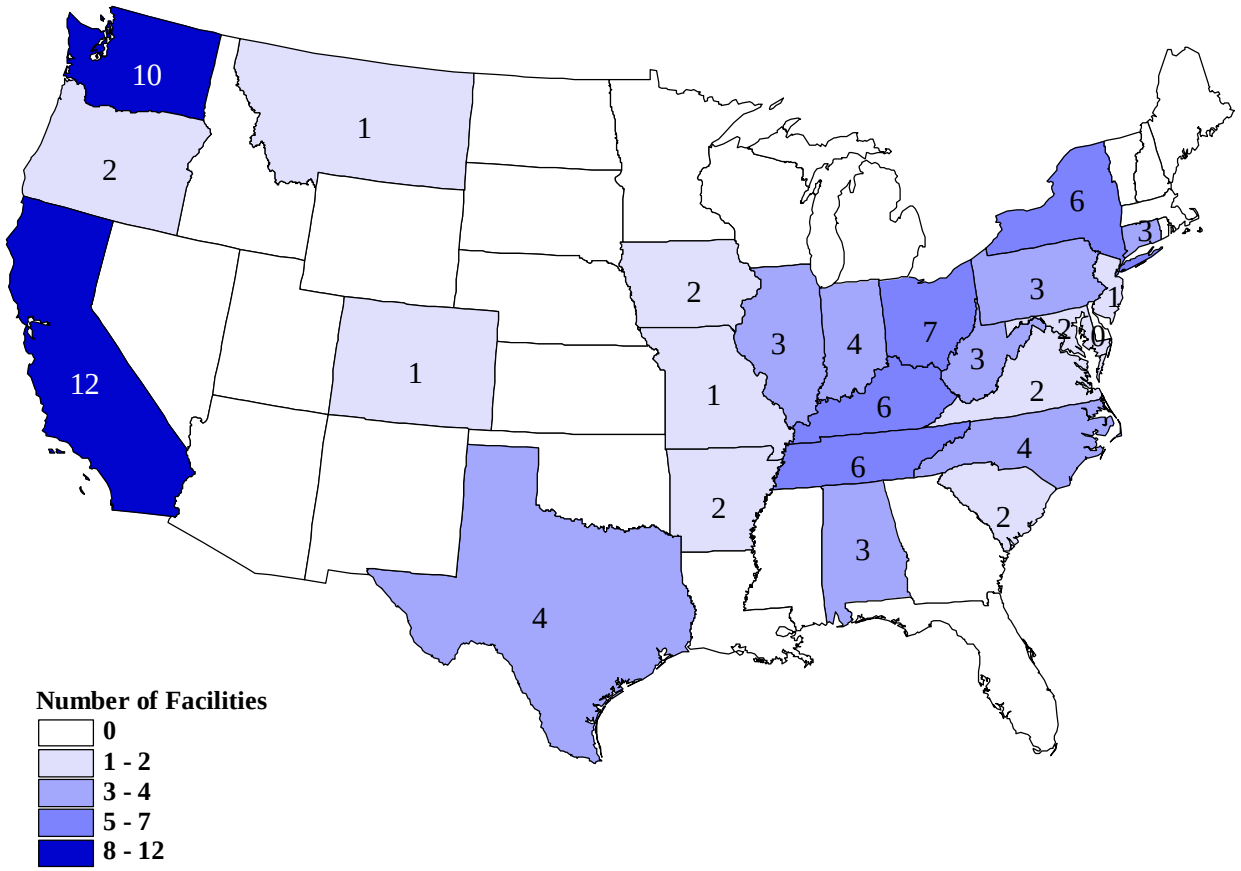
The cost and availability of electricity is a driving force behind decisions on the location of new or expanded smelter capacity.

The primary aluminum producers (SIC 3334) are generally located in the Pacific Northwest (OR, MT, WA) and the Ohio River Valley (IL, IN, KY, MI, MO, OH, PA). In 1998, approximately 39 percent of the domestic production capacity was located in the Pacific Northwest and 32 percent in the Ohio River Valley. Primary smelters are located in these regions due to the abundant supplies of hydroelectric and coal-based energy.

The aluminum sheet, plate, and foil industry is located principally in California and the Appalachian Region (Alabama, Kentucky, Maryland, Ohio, Pennsylvania, Tennessee, Virginia, and West Virginia).

Figure 4E-5 shows the distribution of all facilities in both profiled aluminum sectors (primary smelters and semifabricated product producers), based on the 1992 Census of Manufactures.

Figure 4E-5: Number of Facilities by State for Profiled Aluminum Sectors

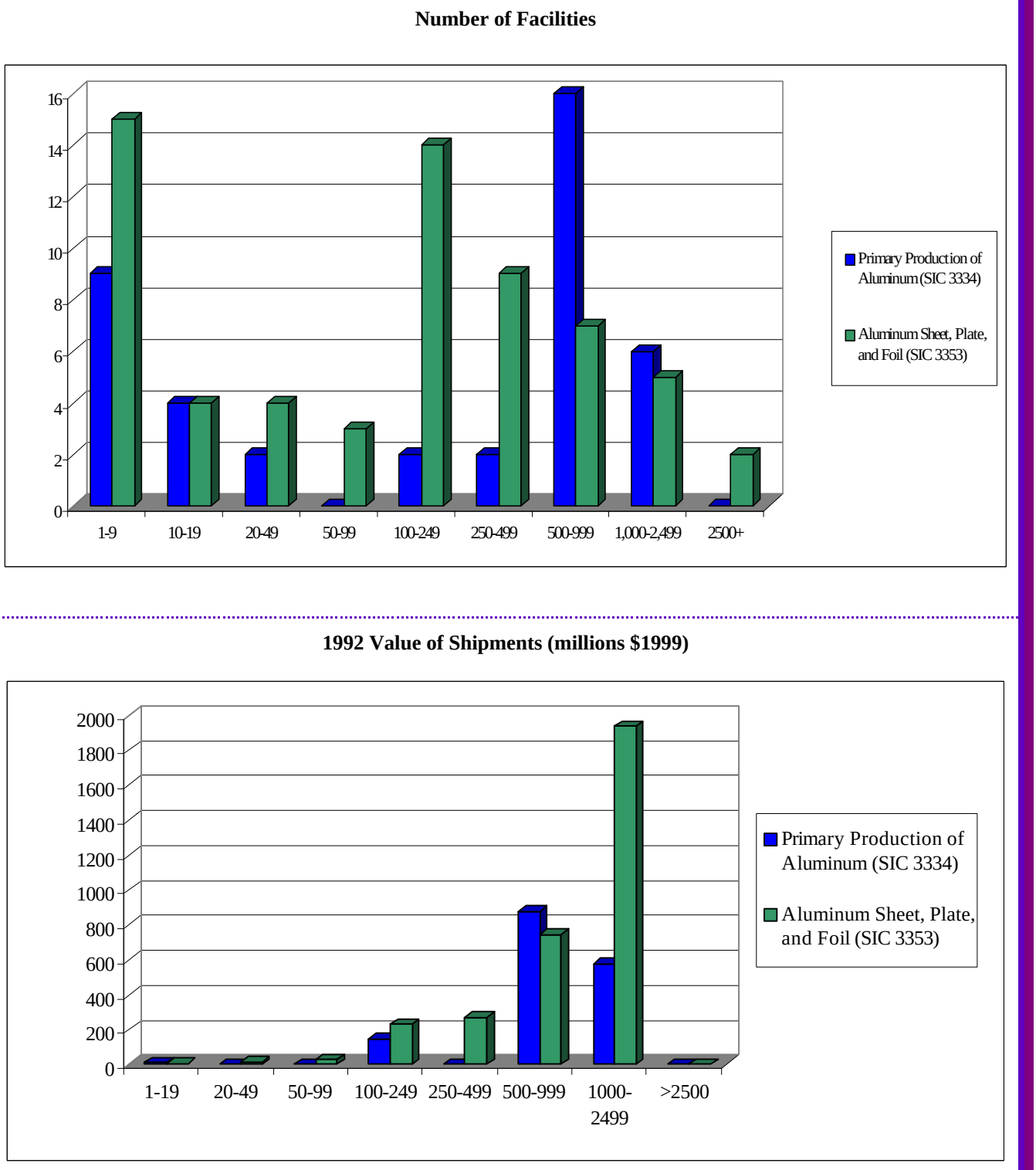


Source: Department of Commerce, Bureau of the Census, Census of Manufactures, 1992.

b. Facility Size

The primary aluminum production and aluminum sheet, plate, and foil industries are both characterized by large facilities, with 59 percent and 37 percent of all establishments employing 250 or more employees, respectively. Figure 4E-6 shows that 93 percent of the value of shipments for the primary aluminum production industry is produced by establishments with more than 250 employees. Approximately 88 percent of value of shipments for the aluminum sheet, plate, and foil industry is produced by establishments with more than 250 employees. Establishments in the primary aluminum production and aluminum sheet, plate, and foil sectors with more than 1,000 employees are responsible for approximately 37 and 53 percent of all industry shipments, respectively.

Figure 4E-6: Value of Shipments and Number of Facilities by Employment Size Category for Profiled Aluminum Sectors



Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

c. Firm Size

The Small Business Administration (SBA) defines a small firm for SIC codes 3334 and 3353 as a firm with 1,000 or fewer and 750 or fewer employees, respectively. The size categories reported in the Statistics of U.S. Businesses (SUSB) do not provide data for firms with more and fewer than 750 and 1,000 employees, and it is therefore not possible to apply the SBA size threshold precisely.

- 27 of the 40 firms in the *Primary Aluminum Production* sector had less than 500 employees. Therefore, at least 68 percent of firms are classified as small. These small firms owned 51 facilities, or 53 percent of all facilities in the sector.
- 41 of the 56 firms in the Aluminum Sheet, Plate and Foil sector had less than 500 employees. Therefore, at least 73 percent of firms are classified as small. These small firms owned 41 facilities, or 51 percent of all facilities in the sector.

Table 4E-7 below shows the distribution of firms, facilities, and receipts in SIC 3334 and 3353 by the employment size of the parent firm. While there are some very small firms in each four-digit SIC code, it is unlikely that these small firms operate the facilities that are most likely to be affected the §316(b) requirements.

Table 4E-7: Number of Firms, Establishments and Estimated Receipts by Employment Size Category for the Profiled Aluminum Sectors, 1996

Employment Size Category	Primary Aluminum Production (SIC 3334)			Aluminum Sheet, Plate, and Foil (SIC 3353)		
	Number of Firms	Number of Facilities	Estimated Receipts ($1999 millions)	Number of Firms	Number of Facilities	Estimated Receipts ($1999 millions)
0-19	20	20	(D)	24	24	33
20-99	4	4		9	9	125
100-499	3	3		8	8	484
500-2,499	5	6	814	2	4	(D)
2,500+	8	18	4,120	13	36	
Total	40	51	4,934	56	81	11,331

(D) Withheld by SBA to avoid disclosure of information on individual operations.

Source: Small Business Administration, Statistics of U.S. Businesses.

d. Concentration and Specialization Ratios

Concentration is the degree to which industry output is concentrated in a few large firms. Concentration is closely related to entry and exit barriers with more concentrated industries generally having higher barriers.

The four-firm ***concentration ratio*** (CR4) and the ***Herfindahl-Hirschman Index*** (HHI) are common measures of industry concentration. The CR4 indicates the market share of the four largest firms. For example, a CR4 of 72 percent means that the four largest firms in the industry account for 72 percent of the industry's total value of shipments. The higher the concentration ratio, the less competition there is in the industry, other things being equal.[2] An industry with a CR4 of more than 50 percent is generally considered concentrated. The HHI indicates concentration based on the largest 50 firms in the industry. It is equal to the sum of the squares of the market shares for the largest 50 firms in the industry. For example, if an industry consists of only three firms with market shares of 60, 30, and 10 percent, respectively, the HHI of this industry would be equal to 4,600 ($60^2 + 30^2 + 10^2$). The higher the index, the fewer the number of firms supplying the industry and the

[2] Note that the measured concentration ratio and the HHF are very sensitive to how the industry is defined. An industry with a high concentration in domestic production may nonetheless be subject to significant competitive pressures if it competes with foreign producers or if it competes with products produced by other industries (e.g., plastics vs. aluminum in beverage containers). Concentration ratios are therefore only one indicator of the extent of competition in an industry.

more concentrated the industry. An industry is considered concentrated if the HHI exceeds 1,000.

The four largest firms in primary aluminum production accounted for 59 percent of total U.S. primary capacity in 1992.

The ***specialization ratio*** is the percentage of the industry's production accounted for by primary product shipments. The ***coverage ratio*** is the percentage of the industry's product shipments coming from facilities from the same primary industry. The coverage ratio provides an indication of how much of the production/product of interest is captured by the facilities classified in an SIC code.

Table 4E-8: Selected Ratios for the Profiled Aluminum Sectors

SIC Code	Year	Total Number of Firms	Concentration Ratios					Specialization Ratio	Coverage Ratio
			4 Firm (CR4)	8 Firm (CR8)	20 Firm (CR20)	50 Firm (CR50)	Herfindahl-Hirschman Index		
3334	1987	34	74%	95%	99%	100%	1934	95%	100%
	1992	30	59%	82%	99%	100%	1456	n/a	99%
3353	1987	39	74%	91%	99%	100%	1719	96%	98%
	1992	45	68%	86%	99%	100%	1633	96%	98%

Source: Department of Commerce, Bureau of the Census, Census of Manufactures, 1992.

e. Foreign Trade

U.S. aluminum companies have a large overseas presence, which makes it difficult to analyze import data. Reported import data may reflect shipments from an overseas facility owned by a U.S. firm. The import data therefore do not provide a completely accurate picture of the extent to which foreign companies have penetrated the domestic market for aluminum.

The International Trade Administration also does not report the value of imports and exports for the two SIC codes of interest. Instead, data are reported for aluminum and bauxite combined (for imports) and for aluminum and alumina combined (for exports). Table 4E-9 provides the value of imports and exports for these categories. The table shows that while exports remained relatively steady over the nine year period, imports have been increasing.

Table 4E-9: Trade Statistics for Aluminum

Year	Value of imports ($1999 millions)	Value of exports ($1999 millions)
1991	2,708	3,516
1992	3,354	2,922
1993	4,087	2,443
1994	5,769	2,882
1995	5,237	3,143
1996	4,767	3,068
1997	5,830	3,592
1998	6,210	3,450
1999	6,400	3,382
Average Annual Growth Rate	*10%*	*-2%*

Source: U.S. Dept. of Commerce, Bureau of the Census; Foreign Trade Statistics.

4E.3 Financial Condition and Performance

The production of primary aluminum is an electrometallurgical process, which is extremely energy intensive. The aluminum industry is therefore a major industrial user of electricity, spending more than $2 billion annually. Electricity accounts for approximately 30 percent of total production costs for primary aluminum smelting. The industry has therefore pursued opportunities to reduce its use of electricity as a means of lowering costs. In the last 50 years, the average amount of electricity needed to make a pound of aluminum has declined from 12 kilowatt hours to approximately 7 kilowatt hours. (Aluminum Association, undated).

Like integrated steel mills, aluminum manufacturers require massive capital investments to transform raw material into finished product. Because of the high fixed costs of production, earnings can be very sensitive to production levels, with high output levels relative to capacity needed for plants to remain profitable.

Operating margin is a measure of how efficiently companies in an industry manage their costs. Relatively small changes in output or prices can have large positive or negative impacts on operating margins (S&P, 2000). Operating margins do not reflect the recovery of capital costs, however, and therefore are only a limited measure of profitability.

Table 4E-10 below shows trends in operating margins for the primary aluminum and aluminum plate, sheet, and foil sectors between 1987 and 1996. The table shows considerable volatility in the trends for each sector. Operating margins for the primary aluminum sector

decreased between 1989 and 1993, reflecting the conditions of oversupply in the market which led to decreasing shipments from U.S. producers (McGraw-Hill, 1998). Those same conditions of oversupply in the market for aluminum led to a steady decrease in prices. Lower prices for aluminum were responsible for lower material costs for the aluminum plate, sheet, and foil sector and a modest increase in operating margins between 1989 and 1992.

Table 4E-10: Operating Margins for the Profiled Aluminum Sectors (Millions $1999)

Year	Primary Aluminum Production (SIC 3334)				Aluminum Sheet, Plate, and Foil (SIC 3353)			
	Value of Shipments	Cost of Materials	Payroll (all employees)	Operating Margin	Value of Shipments	Cost of Materials	Payroll (all employees)	Operating Margin
1987	4,583	2,792	521	28%	12,499	10,320	1,201	8%
1988	5,452	2,913	467	38%	12,537	10,683	1,037	7%
1989	5,545	3,434	520	29%	12,224	9,997	1,027	10%
1990	6,114	4,211	652	20%	11,971	9,345	1,099	13%
1991	6,355	4,656	796	14%	12,110	8,795	1,124	18%
1992	6,538	4,725	901	14%	11,970	8,176	1,140	22%
1993	6,100	4,737	859	8%	11,015	7,847	1,166	18%
1994	5,448	3,710	690	19%	11,600	9,006	1,076	13%
1995	4,909	2,865	548	30%	11,721	9,192	868	14%
1996	5,178	3,347	655	23%	11,883	8,491	1,014	20%

Source: Department of Commerce, Bureau of the Census, Annual Survey of Manufactures.

4E.4 Facilities Operating CWISs

In 1982, the Primary Metals industries withdrew 1,312 billion gallons of cooling water, accounting for approximately 1.7 percent of total industrial cooling water intake in the United States. The industry ranked 3rd in industrial cooling water use, behind the electric power generation industry, and the chemical industry (1982 Census of Manufactures).

This section presents information from EPA's *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures* on existing facilities with the following characteristics:

- they withdraw from a water of the United States;
- they hold an NPDES permit;
- they have an intake flow of more than two MGD;
- they use at least 25 percent of that flow for cooling purposes.

These facilities are not "new facilities" as defined by the proposed §316(b) New Facility Rule and are therefore not subject to this regulation. However, they meet the criteria of the proposed rule except that they are already in operation. These existing facilities therefore provide a good indication of what new facilities in these sectors may look like. The remainder of this section refers to existing facilities with the above characteristics as "§316(b) facilities."

a. Cooling Water Uses and Systems

Information collected in EPA's *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures* found that an estimated 11 out of 31 primary aluminum producers (34 percent) and 6 out of 57 aluminum sheet, plate, and foil manufacturers (11 percent) meet the characteristics of a §316(b) facility. Most §316(b) facilities in the profiled Aluminum sectors use cooling water for contact and non-contact production line or process cooling, electricity generation, and air conditioning:

- All §316(b) primary aluminum producers use cooling water for production line (or process) contact or noncontact cooling. Another 60 percent use cooling water for air conditioning, 11 percent use cooling water for electricity, and 30 percent have other uses for cooling water.

- All §316(b) aluminum sheet, plate, and foil

manufacturers use cooling water for production line (or process) contact and noncontact cooling. Thirty-three percent also use cooling water for air conditioning.

Nine of the 10 §316(b) primary aluminum producers obtain their cooling water from a freshwater stream or river. The other §316(b) primary producer draws from a lake or reservoir. Half of the §316(b) aluminum sheet, plate, and foil manufacturers obtain their cooling water from either a freshwater stream or river, and the other half draw from both lakes or reservoirs and freshwater streams or rivers.

Table 4E-11: Number of §316(b) Facilities by Water Body Type and Cooling System Type for the Profiled Aluminum Sectors

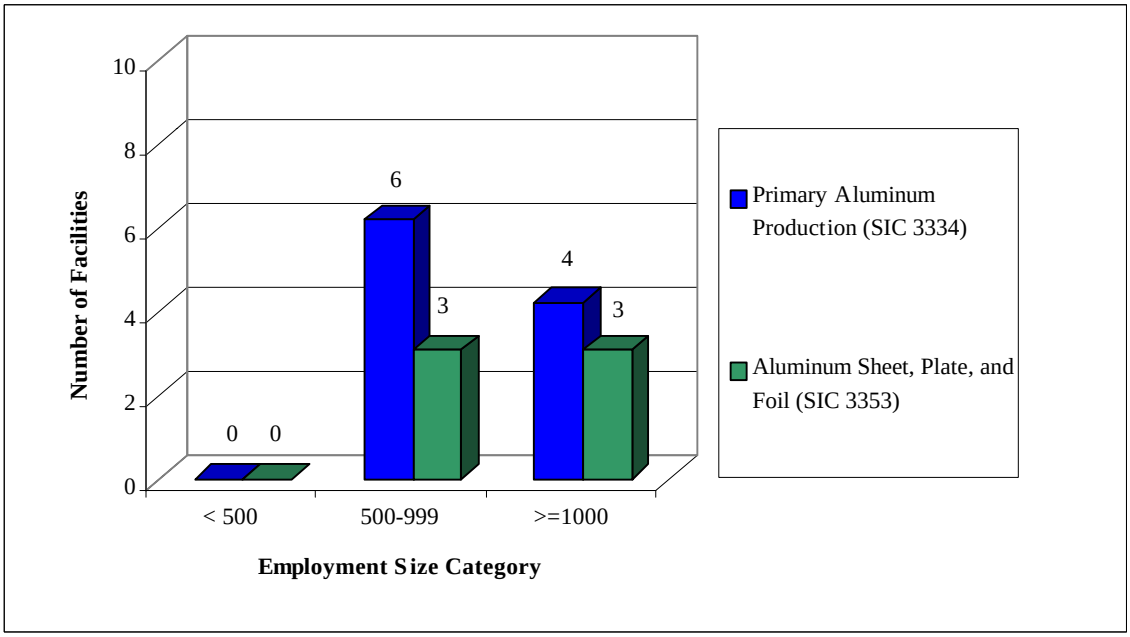
Water Body Type	Cooling System						
	Closed Cycle		Combination		Once Through		Total
	Number	% of Total	Number	% of Total	Number	% of Total	
Primary Production of Aluminum (SIC 3334)							
Freshwater Stream or River	3	33%	3	33%	3	33%	9
Lake or Reservoir	1	100%	0	0%	0	0%	1
Total	***4***	***40%***	***3***	***30%***	***3***	***30%***	***10***
Aluminum Sheet, Plate, and Foil (SIC 3353)							
Freshwater Stream or River	0	0%	0	0%	3	100%	3
Lake and Reservoir and Freshwater Stream and River	3	100%	0	0%	0	0%	3
Total	***3***	***50%***	***0***	***0%***	***3***	***50%***	***6***
Total for Profiled Aluminum Facilities (SIC 3334, 3353)							
Freshwater Stream or River	3	25%	3	25%	6	50%	12
Lake or Reservoir	1	100%	0	0%	0	0%	1
Lake and Reservoir and Freshwater Stream and River	3	100%	0	0%	0	0%	3
Total	**7**	**44%**	**3**	**19%**	**6**	**38%**	**16**

Source: EPA, Industry Screener Questionnaire: Phase I Cooling Water Intake Structures, 1999.

b. Facility Size

Both primary §316(b) aluminum producers and §316(b) aluminum sheet, plate, and foil manufacturers are large facilities, measured by employment size. All of the establishments employ over 500 people and 40 percent of primary aluminum producers and 50 percent aluminum sheet, plate, and foil manufacturers employ over 1,000 employees. Figure 4E-7 shows the number of §316(b) facilities by employment size category.

Figure 4E-7: Number of §316(b) Facilities by Employment Size for the Profiled Aluminum Sectors



Source: EPA, Industry Screener Questionnaire: Phase I Cooling Water Intake Structures, 1999.

d. Firm Size

EPA used the Small Business Administration (SBA) small entity size standards to determine the number of existing §316(b) profiled aluminum industry facilities owned by small firms. Table 4E-12 shows that three of the ten §316(b) primary aluminum producers are owned by small firms. Another 3 are owned by a firm of unknown size which may qualify as a small firm. None of the §316(b) aluminum sheet, plate, and foil facilities are owned by a small firm. One-half of these facilities, however, are owned by firm of unknown size which may qualify as small firms.

Table 4E-12: Number of §316(b) Facilities by Firm Size for the Profiled Aluminum Sectors

SIC Code	Large		Small		Unknown		Total
	Number	% of SIC	Number	% of SIC	Number	% of SIC	
3334	4	40%	3	30%	3	30%	10
3353	3	50%	0	0%	3	50%	6
Total	**7**	**44%**	**3**	**19%**	**6**	**38%**	**16**

Source: EPA, Industry Screener Questionnaire: Phase I Cooling Water Intake Structures, 1999; D&B Database.

REFERENCES

The Aluminum Association. Undated. *Aluminum: An American Industry in Profile*. http://www.aluminum.org

Bureau of Labor Statistics. Producer Price Index.

D&B Database(D&B). 1999. Data as of April 1999.

Executive Office of the President, Office of Management and Budget. *Standard Industrial Classification Manual 1987*.

McGraw-Hill and U.S. Department of Commerce, International Trade Administration. 1999. *U.S. Industry & Trade Outlook.*

Standard & Poor's (S&P). 2000. *Industry Surveys*. "Metals: Industrial." January 20.

U.S. Department of Commerce. 1992. Bureau of the Census. *Census of Manufactures*.

U.S. Department of Commerce. Bureau of the Census. *Annual Survey of Manufactures*.

U.S. Department of Commerce. Bureau of the Census. Current Industrial Reports. *Survey of Plant Capacity*. http://www.census.gov/cir/www/mqc1pag2.html

U.S. Department of Commerce. 1997. Bureau of the Census. International Trade Administration. *Outlook Trends Tables*.

U.S. Environmental Protection Agency (EPA). 1985. Office of Enforcement and Compliance Assurance. *Profile of the Nonferrous Metals Industry*, EPA Office of Compliance Sector Notebook Project. EPA 310-R-95-010. September.

U.S. Environmental Protection Agency (EPA). 1999. *Industry Screener Questionnaire: Phase I Cooling Water Intake Structures*.

United States Geological Survey (USGS). 1998. *Minerals Yearbook.* Aluminum. author: Patricia Plunkert.

United States Geological Survey (USGS). 2000. *Mineral Commodity Summaries* . Aluminum. author: Patricia Plunkert.

U.S. Small Business Administration. *Statistics of U.S. Businesses*. http://www.sba.gov/advo/stats/int_data.html.

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